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Materials Physics  
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Division

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Leonardo Civale

## MPA-STC's Civale named APS Fellow

**C**ongratulations to Leonardo Civale (MPA-STC)! Civale has been named a fellow of the American Physical Society (APS) for seminal contributions to the understanding of anisotropic electrical and magnetic properties of superconductors and vortex physics. He was nominated by the Condensed Matter Physics division.

Civale joined the Laboratory in 2002 as the physics team leader in MST-STC. He received his PhD in physics from the Instituto Balseiro, Bariloche, Argentina. He was a doctoral researcher in the Physical Sciences Department, IBM, T. J. Watson Research Center. Prior to joining LANL, he was a professor at the Instituto Balseiro and head of the low-temperature group at the Centro Atómico Bariloche, Argentina. His research interests are in transport and magnetic properties of superconductors. He made the first demonstration of the high vortex-pinning efficiency of columnar defects created by heavy-ion irradiation. Civale's present research interests include comparative studies of vortex dynamics in different superconductors, the investigation of vortex matter at extreme magnetic fields, understanding the vortex-pinning mechanisms in coated conductors, and the nanoengineering of material defects for critical current enhancement.

Each year, no more than one-half of one percent of the current membership of the APS is recognized by their peers for election to the status of fellow.

In March Civale was invited to give a talk at the APS titled, "Exploring the Limits to Vortex Pinning in Superconductors."

## Materials Capability Review this week

The strength and diversity of materials science at Los Alamos National Laboratory will be on display during the Materials Capability Review, held today through Thursday.

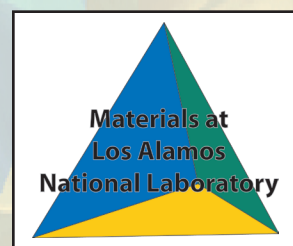
More than 25 groups from 10 divisions will participate in the external capability-centric review, demonstrating the comprehensiveness of Los Alamos' materials program.

These reviews, of which there are approximately seven planned per year, support the Laboratory's goal of being a capabilities-based national security science laboratory, and will highlight the Laboratory's abilities to develop the future Matter-Radiation Interactions in Extremes (MaRIE) signature facility.

Charged with evaluating the quality of science within the materials capability, a distinguished 11-member review committee from universities and national laboratories, chaired by Anthony Rollett of Carnegie Mellon University, will be presented with recent science and technological accomplishments in five theme areas representing a subset of the Laboratory's materials program. Presentations and poster sessions will highlight recent research developments in radiation-matter interactions, synthesis, thermo-mechanical behavior, and nanomaterials. In addition, there will be a session highlighting current materials science at LANSCE. These theme areas are reviewed on a three-year cycle with future reviews focusing on other themes areas to be determined.

The review, being organized by the Experimental Physical Sciences Associate Director, is held in the Jemez Room at the Study Center, with classified sessions in the NSSB Director's Conference Room.

Members of the Los Alamos materials community are invited to attend the sessions. The final agenda is available at [int.lanl.gov/orgs/mst/files/MCR\\_2008\\_agenda.pdf](http://int.lanl.gov/orgs/mst/files/MCR_2008_agenda.pdf).



*From Alex's desk*

## MPA: Showcasing our experimental capabilities

From today through Thursday Los Alamos is hosting a Materials Capability Review. As you may know, the Laboratory no longer hosts division reviews. Instead, the institution is taking a broader approach where “materials research” is viewed as an institution-wide capability with several divisions participating. This year the review will include the following themes: radiation-matter interactions, led by Mark Bourke, MST-8 deputy group leader; designed materials synthesis, led by Dan Thoma, Materials Design Institute director; nanomaterials, led by Toni Taylor, MPA-CINT center leader; thermo-mechanical behavior, led by John Wills, T-1 group leader; and LANSCE, led by Kurt Schoenberg, deputy associate director, Experimental Physical Sciences. Susan Seestrom is the Institution host and Paul Follansbee the technical host. Paul and I hold regular meetings related to the Materials Capability Review. The final agenda is available at [int.lanl.gov/orgs/mst/files/MCR\\_2008\\_agenda.pdf](http://int.lanl.gov/orgs/mst/files/MCR_2008_agenda.pdf) and members of the Los Alamos materials community are invited to attend.



Committee, visited the Laboratory. During his visit, Senator Bingaman, accompanied by Director Michael Anastasio and Principal Associate Directorate for Science, Technology, and Engineering Terry Wallace, met with Kevin Ott, MPA-MC group leader and national program leader for the Department of Energy's Hydrogen Storage Center of Excellence. Ott briefed Senator Bingaman on the Laboratory's approach to chemical energy storage and the role our division plays in that arena. He also discussed how to increase the energy density of capacitors. Senator Bingaman stated that he was impressed by the Laboratory's potential to improve energy storage capacity, and noted that the production and effective use of energy storage were important aspects to improve.

### Congratulations MPA-CINT, recipient of DOE Secretary's Project Management Award

On March 18, Secretary of Energy Samuel Bodman presented the DOE Award for Achievement to the Los Alamos National Laboratory/ Sandia National Laboratories Center for Integrated Nanotechnologies (CINT) at the biannual DOE project management workshop in Washington, DC. As one of two DOE engineering/construction projects receiving recognition, the CINT project team was praised for effective management of the construction and instrumentation of two new research

### Senator briefed on Laboratory's energy security capabilities

On March 27, Sen. Jeff Bingaman, D-N.M., chairman of the Senate Energy and Natural Resources

“Desk” continued on page 3



MPA-MC Group Leader Kevin Ott (left) briefs Senator Jeff Bingaman (right, center) on how nanoscience research can potentially increase the energy density of commercial supercapacitors. Senator Bingaman was accompanied by Laboratory Director Michael Anastasio and Principal Associate Director Terry Wallace.



## “Desk” Continued from page 2

facilities, totaling more than 130,000 sq.-ft. of laboratory, cleanroom, and office space. The \$75M project was formally completed in April 2007—on schedule and under budget. In addition, initial operations in the new facilities were able to start much earlier in 2006 than originally scheduled. The integrated SNL/LANL project team credited extensive intra-team communication and planning for their ability to respond to unanticipated challenges, such as the LANL “stand-down,” federal budget continuing resolutions, and construction cost escalations.

### MPA-11 service recognition

MPA-11 recently celebrated the 25-year service anniversaries of Fernando Garzon and Dipen Sinha at a lively pizza party. Fernando has a long-standing and well-recognized reputation for his work on energy programs. Dipen’s inventive solutions to national energy security challenges were highlighted in a recent article in *Currents* ([int.lanl.gov/news/currents/2008/apr/ace.shtml](http://int.lanl.gov/news/currents/2008/apr/ace.shtml)). Their scientific reputations are a credit to the Division and the Laboratory.

### MPA-WSST: working with you on safety and security

Please keep engaging with the Division’s WSST team members. Any team member would be happy discussing and working with you on any safety issues. MPA-WSST team members are Chris Sheehan (chair), MPA-STC; Eric Bauer, MPA-10; Roger Lujan, MPA-11; Clay Macomber, MPA-MC; Chuck Mielke, MPA-NHMFL; Darrell Roybal, MPA-NHMFL; and Darrick Williams, MPA-CINT. For more information about MPA-WSST please visit [int.lanl.gov/orgs/mpa/mpa\\_wsst/](http://int.lanl.gov/orgs/mpa/mpa_wsst/).

— Interim MPA Division Leader Alex H. Lacerda



Interim MPA Division Leader Alex H. Lacerda (left), Fernando Garzon, and Acting MPA-11 Group Leader Cathy Padro (right).



Interim MPA Division Leader Alex H. Lacerda (left), Dipen Sinha, and Acting MPA-11 Group Leader Cathy Padro (right).

# Heads UP, MPA!



## MPA-WSST quashes rumor

The MPA Worker Safety and Security Team (WSST) not only works to resolve issues for fellow employees via pushing for changes in policy, it also clarifies information and, in this case, corrects an erroneous rumor. There is a rumor that some types of ergonomic incidents were taken off the list of eligible ergo-incidents used for calculating the Lab's total recordable case (TRC) rates. Since ergo-incidents are one of, if not the, leading cause of worker injuries at the Laboratory, reducing the number of ergo-incidents used for calculating the TRC could significantly improve the Laboratory's safety record. Indeed, this supposed reduction in ergo incidents used for reporting is assumed by some to be behind the Laboratory's recent lower TRC rate and the quantitative improvement in Laboratory safety.

Supposedly, some (or all) of the other DOE sites have already reduced their ergo incidents used for reporting and improved their safety records. The Laboratory, according to the rumor, is simply trying to improve its safety record too.

To help separate fact from fiction we spoke at length with Howard Nekimken (chair of the Institutional WSST), Betsy Grindstaff (MPA-IHS), and Bethany Rich (VPP office lead). According to them these are the facts. Treatment for carpal tunnel syndrome (CTS) and other repetitive stress injuries often includes issuing a wrist splint. These splints come in two kinds: soft and rigid. According to injury-recordability requirements, when a rigid splint is issued for treatment, the injury is reportable, but issuing a soft split means the injury is classified as a first-aid case and not reportable.

Due to a misinterpretation of these requirements, LANL has been counting the issuing of both splits as a first-aid case. Thus, the issuing of rigid splints was not reflected in the Laboratory's TRC rate, as required.

Once the misinterpretation was discovered, LANL backtracked to June 2006 and corrected for all injury cases that issued rigid splints. This raised the Laboratory's TRC rates for these prior years. The baseline for comparing changes in the annual TRC rate has also been raised accordingly.

In spite of the correction, the total of LANL's ergonomic-related recordable, plus non-recordable, injuries are still down about 45% from this time last year. This reduction indicates an improvement in worker safety.

Note that Workers' Compensation (WC), which is under New Mexico state control, has recently determined that CTS-like symptoms occur in the general population regardless of whether or not they do repetitive activities. Thus, WC no longer considers as many CTS-like cases to be work-related. This determination by WC does not affect accessibility to treatment or affect the Laboratory's TRC statistics, but can affect the worker's eligibility for WC benefits.

Other issues MPA-WSST has been working on for you in the last month include the following:

- MSL badge reader and after-hours access;
- CINT crosswalk;
- Rockfall on and near roadways, like the truck route;
- Energized-electrical-training plans;
- New nanomaterial guidance document.

*Heads UP, MPA! reports on environment, safety, and health, security, and facility-related news and information.*

## Observation of multiple-gaps superconductivity in $\text{Mg}_{10}\text{Ir}_{19}\text{B}_{16}$

In all superconductors, symmetries such as time-reversal symmetry and inversion symmetry impose important limitation on pairing states.

In work recently published in *Physical Review Letters*, Tomasz Klimczuk, and coworkers Filip Ronning, Vladimir Sidorov, Joe Thompson (all MPA-10), and Robert Cava (Princeton University) investigate  $\text{Mg}_{10}\text{Ir}_{19}\text{B}_{16}$ , a new super-conductor discovered by Klimczuk. This new superconductor does not possess inversion symmetry. Normally, Cooper pairs are in a spin-singlet state or a spin-triplet state, according to parity. The lack of an inversion center in the crystal lattice allows a parity-mixed superconducting state and unconventional behaviors are expected. Although there are few examples of non-centrosymmetric superconductors, this field is attracting much attention due to recent experimental observations in related systems, which may be a consequence of this unusual symmetry breaking. In  $\text{Mg}_{10}\text{Ir}_{19}\text{B}_{16}$ , Klimczuk et al find the thermodynamic properties insensitive to the lack of inversion symmetry; however, tunneling measurements reveal the presence of multiple superconducting gaps, as one might expect due to the mixing of spin-singlet and spin-triplet order parameters.

More work will be needed to understand the precise role of inversion symmetry breaking in  $\text{Mg}_{10}\text{Ir}_{19}\text{B}_{16}$ . This work was performed under the auspices of the US DOE, Office of Science and partially supported by LDRD.

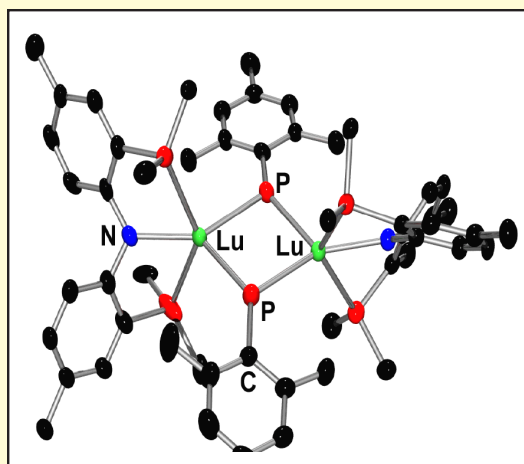
"Physical Properties of the Non-centrosymmetric Superconductor  $\text{Mg}_{10}\text{Ir}_{19}\text{B}_{16}$ " appears in *Phys. Rev. Lett.* **99**, 257004 (2007).

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## MPA-10 researchers prepare the first phosphinidene complex for the lanthanides

MPA-10 researchers, former Director's postdoctoral researcher Jason Masuda (now an assistant professor at Saint Mary's University), former graduate student Kimberly Jantunen, and Jaqueline Kiplinger (MPA-10) have prepared and isolated the first example of a lanthanide metal complex featuring a metal-phosphorus multiple bond ( $\text{Ln}=\text{P}$ ), or phosphinidene, functional group. The lutetium phosphinidene complex exists as a dimer and possesses bridging phosphinidene groups (see figure). Until their work, unlike the transition metals and actinides, lanthanide phosphinidenes were an unknown class of compounds. Due to the electronic mismatch between the "hard" lanthanide and the "soft" phosphorus, these 4f-element compounds could become a platform for catalytic organophosphorus group-transfer processes and other C–P bond-forming reactions. In preliminary reactivity studies, the dimer complex breaks up and reacts like a terminal phosphinidene, transferring the organophosphorus group ( $\text{Lu}=\text{PR}'$ ) to aldehydes and ketones to make phosphalkenes, such as  $\text{R}'\text{P}=\text{C}(\text{C}_6\text{H}_5)_2$ . This "phospha-Wittig" chemistry suggests that it will be possible to prepare a stable terminal lanthanide phosphinidene for direct comparisons with actinide phosphinidene systems.

This new class of molecules is anticipated to provide crucial information concerning the nature of and degree of covalency in Ln metal-ligand bonding, which will enhance our ability to develop 4f-5f element separations schemes for advanced nuclear fuel cycle and waste management efforts within the DOE complex.



**X-ray crystal structure of a lutetium phosphinidene dimer complex.**

This work was performed in collaboration with Brian Scott of (MPA-MC), Oleg Ozerov (Brandeis University), Kevin Noonan, and Derek Gates (both at University of British Columbia), and appears in the *Journal of the American Chemical Society* **130**(8), 2408-2409 (2008), the world's leading journal for the publication of important developments in the chemical sciences. The LANL Laboratory-Directed Research and Development program, the DOE-BES Heavy Element Chemistry Program, the LANL G.T. Seaborg Institute for Transactinium Science, and a Director's Postdoctoral Fellowship funded the research.

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## Celebrating service





## CINT Co-Director Taylor co-chairs Gordon Research Conference on ultrafast phenomena

Center for Integrated Nanotechnologies Co-Director Toni Taylor recently co-chaired a Gordon Research Conference on ultrafast phenomena in cooperative systems.

Also presenting at the conference, held in Lucca, Italy, were MPA-CINT's Kenneth Burch who presented research on "Ultrafast Creation and Destruction of Ferromagnetic Nanowires," and Keshav Dani who presented research on "Ultrafast Spectroscopy of the Quantum Hall System."

The research conference was the second in a series that aims to present a forum for discussion on optically induced nonequilibrium dynamics and photo-induced phase transitions in cooperative condensed matter systems. The main focus of the conference was on time-dependent properties of fundamental and quasi-particle excitations, induced solid-solid and solid-liquid phase transitions, electronic and magnetic switching phenomena, and ultrafast processes in emergent nanoscale systems.

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**Center for Integrated Nanotechnologies Co-Director Toni Taylor.**

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## MPA-STC recognized for excellence in technology transfer with an award from the Federal Laboratory Consortium

A project titled "Second-Generation High-Temperature Superconducting Wire" has received a 2008 Federal Laboratory Consortium Award for Excellence in Technology Transfer. Second-generation (2G) high-temperature superconducting (HTS) wire is a revolutionary development for the electric power industry. Using a patented deposition method developed in MPA-STC, SuperPower, Inc.'s 2G HTS wire can carry 200 times more current than traditional copper wires.

Compared to other HTS wire, the Los Alamos 2G HTS wire is faster to produce, less expensive, and can be manufactured in kilometer lengths. SuperPower has multiple licenses to more than a dozen LANL patents relating to this base technology. MPA-STC won a 2003 R&D 100 Award for this HTS technology, which has now been fully integrated into SuperPower's high-speed manufacturing process. Team members in the project included MPA-STC's Steve Foltyn, Paul Arendt, and Quanxi Jia.

Coupled with other SuperPower innovations, this leading HTS wire manufacturer has produced the world's longest 2G HTS wire with world record performance. SuperPower has supplied these wires to many international customers, including the delivery of approximately 10,000 m of wire to the DOE Office of Energy Delivery and Energy Reliability (EDER) -sponsored Albany Cable project. The wires were fabricated into a 30-meter-long cable that is installed in Albany, NY, making it the first on-the-grid 2G-wire-based HTS device in the world. EDER provided funding to STC and SuperPower for this work as part of its strategy to accelerate the development of 2G HTS wire through partnerships with industry.

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# CINT's Picraux named to inaugural class of Materials Research Society Fellows



**Tom Picraux**

MPA-CINT's Tom Picraux has been elected a Materials Research Society (MRS) Fellow, in recognition for leadership in the application of ion channeling and ion-beam materials-modification

to materials research, and for the advancement of materials science through research management and professional society service.

The inaugural year of the honor, the title of MRS Fellow honors members who are notable for their distinguished research accomplishments and their outstanding contributions to the advancement of materials research, worldwide. Picraux was recognized at the spring MRS meeting.

Picraux joined CINT in 2005 from Arizona State University, where he was professor and executive director of materials research. He is a fellow of the American Physical Society and the AAAS. Picraux, who earned his PhD in engineering science and physics from California Institute of Technology, is a recipient of the Department of Energy's E.O. Lawrence Award for his work in materials research.

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## MPA-10's Durakiewicz elected to Synchrotron Radiation Center User Advisory Committee

Tomasz Durakiewicz (MPA-10) was recently elected to serve on the User Advisory Committee at the Synchrotron Radiation Center (SRC). Located in Stoughton, WI, the SRC is a National Science Foundation-funded national user facility run by the University of Wisconsin-Madison. As a member of the committee, elected for a three-year term, Durakiewicz will provide input to SRC management regarding operations of the light source and the science portfolio of the facility. He will also participate in proposal writing for long-term facility development.

Durakiewicz, who earned his PhD in 1998 in experimental physics from the Maria Curie-Skłodowska University in Lublin, Poland, came to Los Alamos in 2000 as a Director's funded postdoctoral researcher. Now a staff member specializing in photoelectron spectroscopy of f-electron systems, Durakiewicz has authored or co-authored 80 peer-reviewed publications, 130 abstracts and reports, and holds 7 patents.

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